Claims

I claim:

1. A multicarrier transmitter for a waveguide communication system including:
   - multicarrier-signal generator capable of generating a plurality of carrier signals,
   - an information-signal modulator capable of redundantly modulating the carrier signals with at least one information signal, and
   - a coupler capable of coupling the modulated carrier signals into a communication channel.
2. The multicarrier transmitter recited in claim 1 wherein at least one of the multicarrier-signal generator and the information signal modulator provide the carriers with a predetermined relative phase.
3. The multicarrier transmitter recited in claim 1 wherein the modulator is capable of encoding the information signal.
4. The multicarrier transmitter recited in claim 1 wherein the signal modulator includes an address applicator for providing virtual switching.
5. A receiver system for a waveguide communication system including:
   - a multicarrier phase adjuster capable of providing phase adjustment to received multicarrier signals,
   - a combiner capable of combining the phase-adjusted multicarrier signals, and
   - a time-domain receiver capable of processing the combined signals.
6. The receiver system recited in claim 5 wherein the multicarrier phase adjuster includes an optical-to-RF converter.
7. The receiver system recited in claim 5 wherein the multicarrier phase adjuster includes a filter bank capable of separating the received multicarrier components with respect to frequency.
8. The receiver system recited in claim 5 wherein the multicarrier phase adjuster is capable of providing a zero-phase relationship to the received signals.
9. A method of virtual switching including:

- providing for generation a plurality of carriers, the carriers being modulated with an information signal
- providing for phasing of the carriers with a phase relationship that defines an address, the phase relationship matching a dispersion profile of a waveguide with respect to a predetermined distance for providing a predetermined phase relationship of the signal at one or more predetermined locations along the waveguide, and
- providing for coupling the modulated phase-shifted carriers into the waveguide.

10. A method of addressing a multicarrier signal with respect to a dispersion profile in a dispersive waveguide including:
    - providing for adjustment to the multicarrier signal frequencies to provide a phase relationship that matches the dispersion profile of the waveguide, and
    - providing for selection of at least one set of relative phases between the carrier signals that matches at least one dispersion profile for a predetermined length of the waveguide.
11. A multicarrier signal generator including:
    - an information signal source capable of providing at least one information signal,
    - an encoder capable of processing the information signal(s) for producing at least one information bit,
    - a predistortion device capable of providing distortion compensation to the information bits,
    - a multicarrier signal generator capable of generating a plurality of carriers, the carriers being modulated by the encoder with the information bits, and
    - a converter capable of up converting or down converting the modulated carriers.
12. A transport-medium interface for converting a multicarrier waveguide signal to a multicarrier wireless signal, the transport-medium interface including:
    - a receiver coupled to a waveguide capable of receiving multicarrier optical waveguide signals,

- an optical-to-RF converter capable of converting the optical waveguide signals to RF wireless signals, and
- a coupler capable of coupling the RF signals into a wireless channel.

13. A method of providing for adaptation of a multicarrier protocol to generate a composite signal characterized by a predetermined time-domain profile, the method including:
    - providing for generation of a plurality of carrier signals,
    - providing for adjustment of at least one of a set of amplitude and phase of at least one of the carrier signals, and
    - providing for superposition of the carriers to generate a time-domain signal.
14. A method for increasing bandwidth efficiency in a waveguide including:
    - providing for generation of a plurality of sets of multicarrier signals, each of the sets comprising a plurality of multicarrier signals having a plurality of frequencies,
    - providing for selection of a relative-phase relationship within each of the sets, each of the relative-phase relationships matching a dispersion relationship with respect to at least one address of a desired receiver,
    - providing for redundant modulation of the multicarrier signals in each set, and
    - providing for transmission of a portion of each set corresponding to its relative-phase relationship.
15. An address applicator capable of being used as a virtual switch in a dispersive waveguide, the applicator including:
    - a relative-phase selector capable of selecting at least one relative phase between a plurality of carrier signals having different frequencies, the relative phase corresponding to at least one virtual address of a desired receiver, and
    - a packet generator capable of generating at least one packet containing a plurality of the carrier signals, the carrier signals having at least one of the relative phases.
16. A method of providing for reception of a plurality of redundantly modulated multicarrier signals including:

- providing for adjustment of the phase of a plurality of the multicarrier signals received from a communication channel to provide at least one predetermined phase relationship,
- providing for combining of the phase-adjusted received signals to provide at least one time-domain signal, and
- providing for processing of the time-domain signal(s) in a time-domain receiver to detect at least one information signal modulated on the multicarrier signals.

17. A multi-user detector for communication signals in a waveguide, the detector including:
    - a phase-domain sampler coupled to the waveguide, the sampler capable of receiving a plurality of transmit signals from the waveguide for generating a plurality of received signals including at least one desired signal and at least one interfering signal,
    - a weighting system coupled to the sampler capable of receiving the received signals, the weighting system providing at least one weight to at least one of the received signals, and
    - a combiner coupled to the weighting system capable of combining the weighted, received signals to cancel at least one of the interfering signals to enhance at least one of the desired signals.
18. A multi phase-space detector capable of detecting a plurality of information signals modulated into a plurality of signal phase-spaces, the detector including:
    - a coupler coupled to a communication channel capable of coupling a plurality of transmitted signals out of the channel, the coupler providing a plurality of coupled signals having at least one distributed frequency characteristic,
    - a frequency sampler capable of receiving the coupled signals and separating the coupled signals into a plurality of frequency components,
    - a phase processor capable of receiving the frequency components and applying a plurality of phase adjustments to the frequency components, and
    - a combining circuit capable of combining the plurality of phase-adjusted frequency components to generate the plurality of information signals.

19. A multicarrier transmitter capable of generating a coded multicarrier signal, the transmitter including:
    - a carrier-signal generator capable of generating a plurality of carrier signals,
    - a carrier-code generator capable of modulating the carrier signals with a carrier code, and
    - an information-signal modulator capable of redundantly modulating the carrier signals with an information signal.
20. A method of transmitting cascaded-interferometry communication signals, the method including:
    - providing for application of weights to a plurality of versions of at least one information signal,
    - providing for coding the weighted information signals with at least one code having at least one diversity parameter,
    - providing for application of a diversity process to the coded signals based on at least one additional diversity parameter, and
    - providing for coupling the processed, coded signals into a communication channel.
21. A communication system capable of providing channel reuse by canceling interfering signals, the system including:
    - at least one communication channel having at least one receiver node and at least one cancellation node,
    - a cancellation channel coupled between the nodes,
    - a receiver coupled to the receiver node capable of receiving at least one receive signal and coupling the at least one received signal into the cancellation channel to provide a cancellation signal, and
    - a transmitter coupled to the cancellation channel and the communication channel, the transmitter capable of receiving the cancellation signal from the cancellation channel and coupling the cancellation signal into the communication channel to cancel interference resulting from the receive signal.
22. A spatial demultiplexing process comprising:

- providing for reception of a plurality of multicarrier signals modulated with a plurality of interfering information signals,
- providing for separation of the carrier signals into a plurality of discreet components, the components being information-modulated components,
- providing for extraction of values of the information signals from the information-modulated components, and
- providing for separation of at least one of the information signals from at least one interfering signal.

23. A receiver capable of demultiplexing a plurality of information-modulated multicarrier signals, the receiver including:
    - at least one sampler capable of providing at least one sample of the information-modulated multicarrier signals,
    - a separator capable of separating the information-modulated multicarrier signals into a plurality of information-modulated carrier signals, and
    - a multi-user detector capable of receiving the information-modulated carrier signals and separating at least one information signal from at least one interfering signal.
24. A multicarrier receiver including:
    - a sampler capable of sampling a plurality of information-modulated multicarrier signals with respect to a plurality of different values of at least one diversity parameter for generating a plurality of sets of received multicarrier signals,
    - a separator capable of separating the multicarrier signals in each set into a plurality of information-modulated carrier signals,
    - a multi-user detector capable of processing the information-modulated carrier signals in each set to generate a plurality of algebraically unique combinations of information signals, and
    - a combiner capable of combining the sets of algebraically unique combinations to calculate the value of at least one information signal.
25. A reception method capable of providing for separation of at least one information signal from at least one interfering signal, the reception method including:

- providing for reception of a plurality of sampled signals having at least one information signal and at least one interference signal,
- providing for processing the sampled signals into a plurality of algebraically unique equations having at least one unknown information signal and at least one interference signal,
- providing for applying a nonlinear process to at least one of the equations to generate at least one additional algebraically unique equation,
- providing for solving the algebraically unique equations to derive at least one non-explicit relation of at least one unknown signal, and
- providing for inputting possible values of at least one unknown signal to explicitly solve the at least one non-explicit relation.

26. A receiver capable of receiving and separating a plurality of information signals, the receiver including:
    - a sampler capable of sampling received information signals to produce at least one algebraically unique combination of information signals,
    - a nonlinear processor capable of applying a nonlinear process to at least one of the algebraically unique combination of information signals to increase the number of combinations, and
    - a multi-user detector capable of providing information about at least one of the information signals in order to calculate at least one information-signal value.

27. A reception method comprising:
    - providing for reception of a plurality of multicarrier signals modulated with at least one information signal and at least one interfering signal wherein the multicarrier signals are separable with respect to at least one diversity parameter, and
    - providing for processing of the multicarrier signals with respect to at least one alternative diversity parameter that is different from the at least one diversity parameter.

28. A multicarrier receiver including:

- a sampler capable of sampling a plurality of received multicarrier signals with respect to at least one diversity parameter,
- a combiner capable of combining the multicarrier signals, and
- a multi-user detector capable of processing the combined multicarrier signals in the time domain to separate at least one information signal from at least one interference signal.

29. A multicarrier reception method including:

- providing for reception of a plurality of information-modulated multicarrier signals from a communication channel, the multicarrier signals being modulated by at least one information signal and at least one interfering signal,
- providing for diversity combining of the received multicarrier signals in at least one diversity-parameter domain to obtain benefits of diversity, and
- providing for interferometry multiplexing of the received multicarrier signals in at least one diversity-parameter domain to obtain benefits of enhanced capacity.

30. A multicarrier transmitter including:

- a multicarrier-signal generator capable of generating a plurality of multicarrier signals,
- a modulator capable of modulating a plurality of sets of multicarrier signals with at least one information signal, each set including a plurality of multicarrier signals, and
- a coupler capable of coupling the modulated sets of multicarrier signals into a communication channel.

31. A multicarrier reception method including:

- providing for reception of a plurality of information-modulated sets of multicarrier signals, each set containing a plurality of multicarrier signals, each of the multicarrier signals having a different value of at least one diversity parameter, each set being characterized by a different value of at least one diversity parameter,
- providing for separating the sets,

- providing for combining the information-modulated multicarrier signals in each set to provide a plurality of information-modulated sets, and
- providing for interferometry multiplexing the information-modulated sets to separate at least one information signal from at least one interference signal.

32. A feedback method for providing control of differential shift-key constellations and spatial gain distributions of received multicarrier signals to optimize received signal quality, the feedback method including:
    - providing for measuring values of received signals with respect to at least one measurement parameter,
    - providing for calculating an optimal distribution of interferometry channels and differential-modulation channels with respect to at least one of a set of power-efficiency parameters and received signal level parameters, and
    - providing for generating a feedback signal to adjust transmission characteristics with respect to the calculated optimal distribution.

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